STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING

JENNIFER M. GRANHOLM
GOVERNOR

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DIRECTOR

January 30, 2004

Dr. Mark P. Brown
Senior Vice President
Blasland Bouck & Lee, Inc.
174 Union Street Suite 300
New Bedford, Massachusetts 02740

Dear Dr. Brown:

SUBJECT: Response to Blasland Bouck & Lee Comment On Final Remedial Investigation/Focused Feasibility Study Report For the Willow Boulevard/A-Site (Operable Unit 2) of the Allied Paper/Portage Creek/Kalamazoo River Superfund Site, Kalamazoo/Allegan County, Michigan.

This letter acknowledges the Kalamazoo River Study Group's (KRSG) invocation of dispute resolution pursuant to Paragraph 36 of our Administrative Order by Consent (AOC), final order DF0-ERD-91-001. As specified in your letter of January 15, 2004, your dispute is limited to the application of sediment cleanup objectives to soils. This letter attempts to reach agreement on that dispute consistent with the provisions of the AOC. In the interest of resolving the dispute and moving forward, we propose to:

1. Replace certain Remedial Investigation/Focused Feasibility Study (RI/FFS) pages with the enclosed revised pages.
2. Attach your comment letter of January 15, 2004, as Appendix O to the RI/FFS. Your dispute and point of view will become part of the administrative record and will be considered in the course of developing the Proposed Plan.
3. Bring the issue before the Michigan Department of Environmental Quality (MDEQ) Remediation and Redevelopment Division's (RRD) Field Operations Quality Review Team (FOQRT), to determine a RRD position regarding the application of sediment criteria to the floodplain at Operable Unit 2 (OU 2). The FOQRT review will also become part of the administrative record, and will be available for consideration in development of the Proposed Plan.

As I mentioned in our meeting on January 9, 2004, I have already contacted the United States Environmental protection Agency (U.S. EPA) regarding certain KRSG concerns. It is apparent (see enclosed e-mail) that the U.S. EPA shares some of your concern with the application of sediment criteria to the floodplain. As the U.S. EPA will create the Proposed Plan and Record of Decision (ROD) for OU 2, we believe it makes sense to finalize this RI/FFS as-is and await the U.S. EPA's Proposed Plan to see how our respective concerns are addressed. The KRSG, of course, has the option between now and when the Proposed Plan is issued to compile its own technical evaluation and ranking of alternatives to submit for consideration. Further, the KRSG will have an opportunity to comment on the Proposed Plan itself.

That being said, I wish to respond to your letter and offer additional explanation where the text of the RI/FFS may have seemed unclear to you. The MDEQ responses to your general and specific comments follow.

General Comments

1. The RI/FFS focus on groundwater.

The notion that there are no findings of risk related to groundwater at OU2 is an exaggeration. The fact that there have been detections of groundwater contaminants (e.g. polychlorinated biphenyl (PCB), barium, cyanide, mercury, zinc, and bis[2-ethylhexyl]phthalate) in excess of Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451, as amended generic groundwater criteria, soil criteria for the protection of groundwater, and/or generic groundwater surface water interface criteria show that the site represents (1) a release of hazardous substances, (2) a hazard to human health or the environment, or (3) a threat of a release of hazardous substances to the environment. Based on the available data, the MDEQ concludes that hazardous substances in groundwater are reasonably expected to vent to surface water in concentrations that exceed the generic groundwater/surface water interface (GSI) criteria. While a groundwater response action could be required under Part 201, it seems prudent at this time to place GSI compliance wells first to better evaluate the hazard and determine if contaminants are actually being transported to the river.

As you are aware, the RI/FFS is not a decision document. However the RI/FFS is required to consider the long-term uncertainties associated with various remedial actions. Groundwater costs were discussed to establish that (1) there may be additional remedial action necessary in the event contaminants are discharging to the river and that (2) any remedial design should not preclude future groundwater controls. As discussed in the FFS, it may be prudent in early design to evaluate the groundwater issue intensively to determine if there is cost efficiency in including groundwater protection components early. Any RI/FFS that does not objectively evaluate groundwater data or mention potential groundwater costs is incomplete and does not present an accurate statement of site conditions. As you are aware, costs with *and* without contingent groundwater responses were developed for each alternative. There is flexibility in the FFS that may not have been apparent on first reading of the document.

As written in the Blasland, Bouck, and Lee (BBL) letter of January 31, 2001, our agreements regarding groundwater were made with an understanding of how *recent PCB results* would be handled. Our agreement on PCB data was made irrelevant by other site data. In the RI/FFS, the MDEQ also evaluated BBL's inorganic data, non-PCB organic data, and historic PCB results which show significant exceedences of generic criteria. The data show, and Part 201 requires, that the RI/FFS should discuss *all releases*, and options to address exceedences of criteria. Further, Part 201 specifically establishes that cost can be a factor only in choosing among alternatives that offer adequate protection. Given the data, groundwater control was included in the evaluation because it offers adequate protection, whereas alternatives without groundwater control may not offer adequate protection.

2. Sediment Cleanup Objectives.

Application of sediment criteria to the 100-year floodplain in the OU 2 FS is not arbitrary. Your claim that a 100-year floodplain is "submerged as infrequently as once every 100 years" is technically incorrect. The 100-year floodplain, by definition, *every* year has a one percent chance of being inundated. Thus, the 100-year floodplain is *always* subject to inundation and to

the erosive forces of the Kalamazoo River. The hazards associated with PCB contamination of the floodplain are not limited to aquatic exposures during flood events; hazards are also associated with the transport of contaminated floodplain material to the riverbed, where PCB partitioning, aquatic exposure, and bioaccumulation are likely. We remind you that remedial actions taken to reduce the likelihood of PCB transport associated with one percent flood events would be consistent with the actions taken by members of the KRSG during (1) voluntary interim actions at the A-site, and (2) the King Highway Landfill remedial action. During those response actions, sheet pile was extended to an elevation *two feet above* the 100-year floodplain to protect against flood events, erosion, and resulting transport of contaminants. This sensible precaution was carried forward into the OU3 FS.

From the aerial photographs presented previously by the KRSG, it is apparent that the Kalamazoo River in the vicinity of OU3 is dynamic, with deposition of transient islands and resultant changes in river velocity and erosive forces along the banks. It is indisputable that the nature of a river is to meander in its floodplain; erosion of bank floodplain materials and transport of residual PCB contaminants to the river is only a matter of time. Further, it is a certainty that trees will eventually fall and animals will periodically burrow in the floodplain, disturbing residual contaminated material, making it unstable and more susceptible to transport.

One goal of remedies implemented under Comprehensive Environmental Response, Compensation, and Liability Act, 1980 PL 96-510, is to achieve a high degree of permanence. Under Part 201, remedial actions that significantly and permanently reduce the mobility of contaminants are preferred. The highest degree of permanence, considering eventual transport to the river, is achieved by removal of contaminants to levels protective of aquatic ecosystems. Since excavation in the OU 2 floodplain (relatively small) would occur under any action alternative; there is an opportunity at this operable unit, with minimal additional effort, to virtually *eliminate* risk in the floodplain rather than simply reduce it. In this case, the benefits of achieving the greatest possible degree of permanence out weigh the cost of the minimal additional effort. We are not presuming that the same cost-benefit could be realized on all other areas of the river.

From the site data available the +50/-30 cost estimates in the RI/FFS adequately cover the effort to achieve the sediment criteria in the floodplain.

The footnotes on page 6-8 and 6-9 are intended to make it clear that comparing criteria to post-excavation confirmation samples using an acceptable method of spatial averaging is appropriate. Any lack of clarity on this matter in the FS text does not warrant revision. This detail can be clarified in the Proposed Plan and Record of Decision (ROD).

3. An "ecologically-friendly" setback at Willow Boulevard.

As written in the text, for the purposes of cost estimation, the setback for Alternative 2C was assumed to be 50 feet. If a setback remedy is selected by the U.S. EPA, the setback distance could be evaluated and established with greater precision in remedial design. Consistent with the U.S. EPA's approach on other sites, it is likely the KRSG will be given the opportunity to undertake design and make the appropriate evaluations to ensure the design has a solid basis. If the KRSG believes ecologically friendly setback at Willow Boulevard is not protective or permanent, the MDEQ invites the KRSG to provide an analysis for consideration. It is puzzling that the KRSG would question the "risk management tradeoffs" of the alternative, considering the KRSG proposed a similar alternative for other areas of the river.

The MDEQ agrees with your opinion that Alternative 2C does not provide the greatest risk reduction of all alternatives, but the degree of risk reduction is not the only criteria by which a remedy is selected. The MDEQ's ranking was based on (1) our evaluation of the nine criteria established by the National Contingency Plan and (2) the fact that groundwater issues have been complicated by sheet pile at other OUs. It is not a requirement that the KRSG or even the U.S. EPA agree with our FS ranking. There will be additional evaluation in development of the Proposed Plan.

Regarding evaluation of the "community acceptance" criteria, it is rare that community comment to remedial alternatives is available before a Proposed Plan. Historic public comment is available in the case of OU 2; the U.S. EPA and the MDEQ believe utilization of the comments is reasonable. The MDEQ acknowledges sentiment expressed during the official comment period may differ from what has been documented to date. As the preferences of the Lakeside Neighborhood Association are not specifically known, their input will be specifically solicited during Proposed Plan. While immediate neighbors and members of particular neighborhood associations have a stake in the remedy, so does the downstream community; the opinion of *all* stakeholders is important to consider. The relative ranking provided in the RI/FS is MDEQ's and is preliminary, considering all criteria cannot be fully evaluated until the public comment period is complete. For this reason, the U.S. EPA requested that the MDEQ not identify a preferred alternative in the FFS.

4. Evaluations of short-term effectiveness and implementability of remedial alternatives
The MDEQ invites the KRSG to submit its analysis of potential short term risks for evaluation, though the MDEQ determined (and U.S. EPA concurred) that in the previous KRSG iteration of the RI/FFS, descriptions of short term risk were overstated. The MDEQ believes that engineering controls can be used to substantially reduce short term risks.

5. Regulations and requirements.
The physical separation requirement does not apply to "new disposal areas" and the Willow Boulevard A-Site is not a new disposal area as clearly stated in the third sentence of the paragraph. The enclosed pages provide clarification. The point of the paragraph was to establish that design must address leachate if it is coming out of the landfill.

The MDEQ emphasizes that sheet pile alone is not equivalent to a Part 115, Solid Waste Management, of the NREPA cap. At the Willow Boulevard A-Site and King Highway Landfill, use of sheet pile is a perfectly good idea because there are earthen berms that provide additional physical separation between the river and the waste. Using sheet pile alone to separate waste from the river is inadequate. The MDEQ landfill engineers recommend "pushing the waste as far back from the river as possible" at Willow Boulevard A-Site.

Regarding any perceived lack of clarity regarding the relevance of Part 31, Water Resources Protection, of the NREPA, Part 201 Rule 716(5) specifies procedures for demonstrating compliance with Part 31. The procedures accommodate the differences between venting groundwater and permitted discharge to surface water. Also, Part 201 Rule 716 (6) requires that the MDEQ identify water quality standards for hazardous substances developed under Part 31 (generic GSI criteria).

6. Estimated costs for Alternative 3 – Removal and Off-Site Disposal.
The cost evaluated is within the + 50/-30 estimate range, which is typical of a feasibility study. Costs previously provided by the KRSG were overestimated. Because the cost of Alternative 3 is the most costly, it is already the least preferred in that regard. Refining the cost would have little impact on the relative ranking of alternatives using the cost criterion.

7. References used to support MDEQ's assessment of conditions at the OU and community acceptance of each alternative.
The MDEQ is treating the BBL request as if it was made under the Freedom of Information Act, and has included the requested references (enclosed). In the interest of settling the dispute, there will be no bill for photocopying or staff time to respond to the request.

Specific Comments

1. *In Section 1.2, the second sentence inaccurately describes Georgia-Pacific's ownership of the Mill. The Kalamazoo Paper Company owned and operated the Mill until 1967, not Georgia-Pacific* (sic).

The MDEQ acknowledges that Georgia-Pacific did not own and operate the mill until 1967. The sentence in question does not use the term "ownership" and is meant only to describe which facilities, in terms easily understood by the public, used the OU for disposal. Further, the sentence is inclusive of dates beyond 1967, when Georgia-Pacific *did* own and operate the mill. The transfer of the site from the Kalamazoo Paper Company is adequately described in Section 1.2.1.

2. *In Section 1.2.1, the last four sentences in this paragraph grossly misstate the function of the temporary cover placed over the Willow Boulevard Site. The temporary cover was constructed after an interim measure (i.e., removal of residuals from the River) was implemented. At the time of the removal action in 2000, it was anticipated that a final remedial alternative would be selected expeditiously, and Georgia-Pacific arranged for a local contractor to perform maintenance on the temporary cover. However, after three years, a final remedy has not been selected, and the temporary cover system, which was not designed as a long-term measure, is showing only some signs of insignificant deterioration. We suggest these sentences be removed as they provide no benefit to the analysis of alternatives. This issue is repeated in Section 4.1.1.*

The existing cover is described in the RI/FFS as a "temporary measure" and an "interim cover," intended "to stabilize the surface and reduce possible erosion". It is not clear why the KRSG believes this description is a misstatement. The KRSG's previous version of the RI/FFS (Page 3-2), stated only that sand was placed; there wasn't *any* description of intended function. Deterioration of the interim cover has led to erosion of paper residuals into the river, a condition that is hardly insignificant. The MDEQ text was written to describe current conditions and to establish that the temporary cover will not be adequate over the long term.

3. *Under Section 1.4 – Enforcement History, the last paragraph is misleading and suggests the KRSG and BBL have not been responsive to MDEQ's concerns. This paragraph does not include a full description of the long history of the development of the RI/FFS report as illustrated in Figure 1. Absent from this text is any recognition that a final draft of the RI/FFS was developed in 1999 followed by a draft of the Proposed Plan, or that the MDEQ*

approved the use of a presumptive remedy approach only to decide after two drafts of the RI/FFS had been prepared to abandon this approach. There is no mention of the meeting on January 23, 2001 where the MDEQ and the KRSG met and discussed 125 comments, most of which were to expand the document to include information described in Technical Memorandum 9. The MDEQ makes no mention of the letter dated November 1, 2001, where the remaining 25 minor comments were addressed and additional information provided to the MDEQ. In addition, in 2001 we were told by MDEQ's project manger that the remaining changes were very minor, in fact "piddly" was the term used to describe them. The unresolved comments, if any, do not begin to account for the extensive changes made by the MDEQ in this most recent draft.

The paragraph was intended to state that the reason the MDEQ is completing the RI/FFS is because the previous version of the RI/FFS was rejected, because of the reasons identified in our letter of November 19, 2001. The last KRSG version *was* unresponsive to MDEQ's concerns. We believe inclusion of BBL's Figure 1 provides a reasonable account of site history. As an aside, the presumptive remedy approach was abandoned because the U.S. EPA determined it was not appropriate on this Operable Unit. There is no presumptive remedy for a saturated landfill, placed in a river and its floodplain.

4. *Starting on Page 2-30, the MDEQ states that certain Aroclors are identified. This is not a completely accurate characterization since PCBs were not actually identified as comprising a particular Aroclor, but rather were merely quantified as that Aroclor.*

This comment is puzzling, as the language in RI Section 2.10 is nearly identical to Response 3 in BBL's letter of November 1, 2001. BBL is apparently taking issue with its own text.

5. *The statement in the last sentence of the second paragraph on page 3-6 is a non sequitur and does not belong in a section discussing site hydrogeology.*

This statement was admittedly a poor way of saying that the conductivities of the residuals at the Operable Unit are not the same as the conductivities of residuals in the downstream impoundments, where mixing has occurred. The MDEQ was attempting to establish that BBL's conductivity estimates at the OU cannot be applied to any other portion of the Kalamazoo River Superfund site. A change has been made.

6. *In Section 4.2.7, the fourth paragraph, the MDEQ implies that validation of historical data was attempted but could not be completed as prescribed in the quality assurance/quality control (QC) Review of Historical Studies Data Plan. This is incorrect. The prescribed method was followed, but the data could not be validated due to the lack of available QC data for the historic results.*

This comment is not warranted as the fourth paragraph is nearly identical to text written by BBL in its previous version of the RI/FFS. We are left to acknowledge that BBL now has concerns with "implications" that may or may not be present in its own suggested text.

7. *In the last sentence on page 5-2, the statement that "...generic GSI values are intended to ensure that contaminants in groundwater are not discharged to surface water" is not accurate.*

The text paraphrases the title of Part 201 Rule 716, which is "Cleanup criteria for groundwater based on protection of surface water resources from hazardous substances in venting

groundwater." While it is better to state that the intent of GSI criteria is to protect against discharge of *unacceptable concentrations of* contaminants, we note that this distinction is not made in the title of the rule itself. It is clear that insignificant discharges of contaminants are not precluded because GSI criteria are not zero values. A change to the text was made.

8. *Portions of the RI report inappropriately include discussions specifying portions of the remedy. For example, in Section 5.3 there are references to studies and evaluations that would be part of a Hydrogeologic Monitoring Program, including evaluations of zinc, mercury, and leachate;* (sic).

The text does not specify parts of a remedy. Rather, this section simply states that additional monitoring could help resolve some of the pending questions regarding groundwater contamination. While the existing dataset may, at this time, be insufficient to justify a groundwater remedy, the dataset is also not sufficient to conclude that groundwater poses an acceptable risk. Further, the MDEQ text is actually less stringent than text previously suggested by BBL. For example, in the March 2001 version of the RI Section 4 and Section 5, BBL made statements such as, "a long-term groundwater monitoring program will be implemented as part of any selected alternative that entails leaving the residuals in place." Again, BBL is apparently taking issue with statements that it previously deemed appropriate.

9. *In Section 6.2.1.3 and several others, the MDEQ implies that PCB concentrations greater than 12 parts per quadrillion (ppq) for wildlife or 2.6 ppq for humans present a risk. This is not an accurate assessment, as these values assume there is no risk at these levels, they do not imply that there is risk if PCB levels are greater than these concentrations.*

The 0.00012 ug/L in the RI text is the "Wildlife value, " the maximum ambient water concentration of a substance at which adverse effects are not likely to result in population-level impacts to mammalian and avian wildlife populations from lifetime exposure. The 0.000026 ug/L value is the "Human non-cancer value, " the maximum ambient water concentration of a substance at which adverse non-cancer effects are not likely to occur in the human population from lifetime exposure through either drinking the water, consuming fish from the water, and conducting water-related recreation activities. The implication that any higher concentration may result in adverse effects is reasonable. The MDEQ emphasizes that remedial response objectives for this Operable Unit do not include specific surface water concentrations. If concentration-specific remedial response objectives (RROs) at this OU are set, they should be set according to the Baseline Ecological Risk Assessment; surface water concentrations should not exceed 0.00197 ug/L to protect mink. As the enclosed references establish, evidence of mink has been observed near OU3. A change to the text was made.

10. *In Section 6.2.1.5, The MDEQ suggests that the information gathered during the RI is "...insufficient to definitively determine whether groundwater/leachate poses an unacceptable risk...." This is an overstatement because with reasonable assumptions, as those considered in the King Highway Landfill-OU Risk Assessment, there would be no risk associated with groundwater/leachate exposure. In the early versions of the Willow Boulevard/A-Site RI/FFS, BBL calculated a site-specific GSI using the MDEQ guidance; however, the agency did not accept this attempt to illustrate that a risk did not exist using reasonable assumptions.*

The King Highway risk assessment did not evaluate GSI criteria (which were established with reasonable assumptions), and did not look at potential GSI impacts to wildlife. Considering the differences between King Highway Landfill and the Willow/A-Site OU, application of the King Highway Landfill risk assessment to OU2 is not appropriate. However, the MDEQ notes one relevant statement from the King Highway risk assessment:

> "...the presence of elevated levels of PCB in residuals is recognized, especially in terms of potential bioaccumulation/food chain effects. The greatest potential for ecological exposure and significant risk arises from the potential food chain effects on organisms."

11. *In Section 6.2.1.5 there is a discussion of a groundwater/leachate monitoring plan. This is not appropriate for a section discussing site risk.*

The MDEQ is again puzzled by the KRSG making such a comment. Language suggested by BBL in its last version off the RI/FFS included "development of a long term groundwater monitoring network to ensure there is no migration of PCB from leachate or groundwater." This comment represents the fourth instance in which BBL has questioned its own language.

12. *In Section 7.2.2, description of Alternative 2, there are several sub-alternatives (e.g., On-Site Consolidation of Select Residuals) where sediment containing PCB concentrations of 6.5 to 8.1 milligram per kilogram will be removed. This is inconsistent with the RRO for sediment. Additionally discussions of removal suggest that at any location where PCB concentrations exceed the criteria, the area will be re-excavated. This approach does not consider the use of spatial averaging as discussed in general comment #2, above.*

With little additional effort (and consistent with a +50/-30 estimate) removal of materials triggered by exceedences of the terrestrial criteria can probably achieve sediment criteria, where appropriate. Use of appropriate methods of spatial averaging as a tool to determine adequacy of cleanup is assumed.

13. *Under Alternative 4 – Compliance with applicable or relevant and appropriate requirements (ARARs), the MDEQ states that Part 31 establishes state cleanup criteria to be used while "remediating rivers, creeks, and floodplain areas." This is not accurate and overstates the scope of Part 31.*

We agree on this point; such language, *previously provided by BBL in other versions of the RI/FFS*, had been removed by the MDEQ from all other sections of the document. Leaving the inappropriate language here was an oversight and a change has been made.

14. *It is not clear why a discussion of Toxic Substances Control Act (TSCA) as an ARAR is only included in the analysis of Alternative 4.*

TSCA is specifically discussed in the analyses under Alternative 1 ((Page 7-4), Alternative 2 (Page 7-12), and Alternative 3 (Page 7-32). If the hard copy version you received does not include these discussions, please let us know.

15. *The Weighting of Various Alternatives in Table 7-4 produces several counterintuitive results that suggest revision of the comparative analysis is warranted. For example, Alternative 3 (Complete Removal) is rated higher than three of the consolidation alternatives, and rated*

lower than only Alternative 2C, which is quite similar to the lesser rated consolidation alternatives.

Perhaps BBL is reading Table 7-4 incorrectly, or has not reviewed the supporting pairwise comparison pages (see Appendix N). Looking at the pairwise analysis by criteria, Alternative 3 is rated lowest in terms of cost, implementability, and higher than only "no action" in terms of short term effectiveness. This is intuitive. Alternative 3 is clearly the most protective, has the most permanence, and is most likely to get the state and community acceptance. In terms of ARARs, such as Part 301 and Part 303, all action alternatives may be restricted in some degree because of floodplain construction constraints. While overall ranking may seem counterintuitive to BBL, when the ranking is broken down according to criteria, the basis for the overall ranking is clear.

16. *Further site investigations for the King Mill pipe, residential soil sampling, and groundwater should not be specified in the RI/FFS for the WB/A-Site OU.*

These unknowns must be resolved in design, as they could impact the scope of the remedial action.

We trust our revisions, our proposal to attach your comments as Appendix O to the RI/FFS, and our commitment to clarify the application of sediment criteria with the FOQRT is responsive to your dispute. The MDEQ now considers the RI/FFS for OU 3 a final document.

If you have any questions regarding anything in this letter, please contact Mr. Keith Krawczyk, Project Manager, Specialized Sampling Unit, Superfund Section, at 517-373-4103.

Sincerely,

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517-373-6808

Enclosures

cc: Ms. Shari Kolak, U.S. EPA
Ms. Karen Cibulskis, U.S. EPA
Mr. David Kline, MDEQ
Mr. Paul Bucholtz, MDEQ
Mr. Brian Monroe, MDEQ

Figures (Cont'd)

Photos

Aerial Photos

Appendices

The deeper deposits contain materials with green, gray-green, brown, and dark green colors and a texture of paper fibers with some to "trace" (<10 percent) clay. The residuals were damp at the surface at most locations, with moisture content increasing to moist with depth. At well clusters on the A-Site, saturated zones within the residuals were encountered, necessitating the installation of shallow perched residuals wells (AMW-6P, AMW-7P, AMW-9P, and AMW-10P) (Figure 12). The subsurface logs for all the borings and groundwater/leachate monitoring wells are included in Appendix H.

Based on a review of groundwater elevations collected on November 10, 2000 (summarized in Table 3-2 of this report), the water table exists at an elevation above the base of the residuals at the following monitoring well clusters: AMW-1, AMW-7, AMW-8, AMW-9, AMW-10, and WMW-3 (Figure 4). As presented on the geologic cross-sections A-A' and C-C' (Figures 12A and 12B, respectively), the interior and western portions of the Willow Boulevard Site contain residuals that have been shown to exist to 7 feet below the groundwater table. As presented on the geologic cross-section A-A', B-B', and D-D' (Figures 12A, 12B, and 12C, respectively), the interior of the A-Site also contains residuals that exist up to 4 feet below the groundwater table.

The native soil immediately below the residuals at the Willow Boulevard Site is either a dark brown organic peat or fine to coarse sands. Cross-section A-A' (Figure 12A) shows a brown fine to coarse sand directly beneath the residuals on the eastern side of the Willow Boulevard Site, which in turn, is underlain by a light brown fine sand layer. On the western side of the site, the residuals are underlain by peat followed by the light brown fine sand unit. Cross-section B-B' (Figure 12B) shows that the residuals in the vicinity of the central portion of the Willow Boulevard Site are underlain by a deposit of fine to coarse sand. The brown fine to coarse sand is underlain by the light brown fine sand unit.

The native soil immediately below the residuals at the A-Site is almost entirely peat (Figure 12A) with the exception of small southern and northern portions of the site, where the residuals are underlain by a light brown fine sand unit (Figure 12B). The peat is underlain by the fine sand unit in the northern and southern portions of the site and by a fine to coarse sand unit in the central portion of the site. The layer of peat formed historically along much of the floodplain of Kalamazoo River above the fluvial sands and glacial deposits. This peat/organic silt unit typically marks the transition between native deposits and overlying fill materials added throughout the operational history of this OU.

Two deeper borings (GEO-1 and GEO-2; Figures 12B and 12A, respectively) were advanced below the fine sand unit at the A-Site. Within GEO-1, the fine sand unit is underlain by an 18-foot thick medium to coarse sand and gravel unit. The sand and gravel unit was encountered at approximately 32 feet bgs. At approximately 50 feet bgs, this sand and gravel unit is underlain by dense silt to approximately 55 feet bgs followed by a 10-foot thick gravel layer. A second dense silt layer with a trace of shale fragments was encountered from 65 feet bgs to the base of the boring at 72 feet bgs. Within GEO-2, the fine sand unit is underlain by sand and silt, fine sand, and a 23.5-foot thick medium to coarse sand and gravel unit. The coarse sand and gravel unit was encountered at approximately 41.5 feet bgs. At approximately 65 feet bgs, this sand and gravel unit is underlain by a dense silt layer to approximately 67 feet bgs, followed by a 1.5-foot thick fine sand layer. A second dense silt layer was encountered from 67.5 feet bgs to just below 71 feet bgs. Weathered shale bedrock was encountered below the second dense silt layer to the base of the boring at 73 feet bgs.

Hydraulic conductivity estimates, based on slug tests conducted on wells installed in the various subsurface units, range from 8.8E-2 to 1.7E-4 centimeters per second (cm/s). The berms at the A-Site were typically constructed directly over the peat unit near the Kalamazoo River. Over time, as wastewater from the paper-making operations was decanted, residuals settled out and accumulated behind these berms. As a result of clay content, residual deposits may have hydraulic conductivity values (based on studies of other paper waste sites) ranging from 4.2E-4 to 5.8E-8 cm/s (Maltby and Eppstein, 1996). The hydraulic conductivity estimates of WB/A residual material, based on slug tests conducted on wells installed within the residuals, range from 2.0E-3 to 1.7E-4. The more highly compressed and compacted residuals near the base of the deposits could be represented by the lower hydraulic conductivities. In comparison, the estimated hydraulic conductivity values determined for the native glacial materials range from 8.8E-2 to 4.3E-4 cm/s. It should be noted that while low conductivity values reflect some residuals in place at the OU, they cannot be applied to other areas of the river, where the residuals have mixed with native materials.

Potentiometric surface elevations and the in-situ hydraulic conductivity data were used to evaluate groundwater flow rates and directions. Water table contour maps for the WB/A-OU were generated based on water level data collected on October 11, 1993; August 30, 1995; and November 10, 2000. These contour maps are presented as Figures 13A, 13B, and 13C, respectively. The apparent general groundwater flow direction within the water table beneath the Willow Boulevard Site is from the south to the north; groundwater flow direction within the water table beneath the A-Site is generally from the southeast to the northwest with some deflection of groundwater toward the northwest in the direction of Davis Creek along the western edge of the A-Site. A comparison of the water table contour maps depicting pre-sheetpile installation (Figures 13A and 13B) and post-

5. Fate and Transport

This section describes several key factors to be considered regarding the potential fate and transport of PCB at the WB/A-OU. The potential PCB transport pathways from the WB/A-OU include erosion of residuals/soils and sediment from surface runoff, transport within groundwater and air, and migration of groundwater through the banks/dikes.

5.1 Residuals/Soils Attenuation Capacity

The capacity of residuals/soils to attenuate PCB transport is related to the organic content of the material. The principal constituents of concern at the WB/A-OU are PCBs, which have a high affinity for organic matter. The residuals in which PCB have been identified at the WB/A-OU have organic contents ranging from approximately 27 percent to approximately 70 percent by weight. Table 5-1 summarizes the results of organic content analyses of selected samples at WB/A-OU. Detailed results can be found in *Technical Memorandum 9* (BBL, 1995b).

Values of organic carbon content of soils may be reported as total organic matter by multiplying the organic carbon content by the conventional "Van Bemmelen factor" of 1.724 (Allison, 1965). The use of this factor is based on the assumption that organic matter contains 58% carbon. Using the Van Bemmelen factor of 1.724 to convert the fraction of organic matter to total organic carbon (TOC), the approximate range of organic carbon content of the residuals is estimated to be between 16 and 40 percent TOC. Appendix M provides the derivation of this calculation.

5.2 Transport via Erosion of Residuals/Soils and Sediment

The soil and sediment PCB data generated during the RI and supplemental investigations indicated that PCB are present in surface residuals/soils and sediments. At the Willow Boulevard Site and drainageway, the area south of the A-Site, the area east of Davis Creek, and the AMW-3A area, a pathway exists for PCB transport via surface runoff since the surficial residuals/soils contain PCB. Suspension and migration of contaminated materials may be associated with surface water flow in Davis Creek, the former Olmstead Creek, and the Kalamazoo River, as well as with runoff from the Willow Boulevard, the area east of Davis Creek, the area south of the A-Site berm, and from the AMW-3A area. Off-site transport via erosion from the A-Site is limited by the perimeter dike and sheetpile wall at the A-Site. In addition, a potential erosion pathway exists at the A-Site for the residuals/soils outside of the dikes and sheetpile wall Due to the affinity of PCB for organic material as discussed in Section 5.1 (e.g., soil and sediment particles), transport via the erosion pathway would be primarily associated with the erosion of PCB-containing soil surfaces or stream sediments.

5.3 Fate and Transport Within Groundwater

The fate and transport of PCB in the environment is limited by their low water solubility. This generally limits aqueous phase concentrations to the low part per billion (ppb) range or less (Baker et al., 1986). In low permeability soils, such as those at the WB/A-OU, movement in leachate or groundwater is likely to be restricted. In general, the adsorption of PCB to soils and sediment increases with increasing organic content, decreasing particle size, and increasing congener chlorination (Lyman et al., 1982).

The groundwater quality data collected for the OU during the 1993 and 1995 field activities detected PCB in monitoring well WMW-3A. The results of additional investigation support the hypothesis that the past detections of PCB at monitoring well WMW-3A may be an artifact of well construction. Well construction details can be found in Appendix C of this report and the results of the groundwater sampling are summarized in Section 4.2.7 of this report.

PCBs were detected at the AMW-3A area and at AMW-4. The PCB detections at the AMW-3A area are thought not to be derived from the A-Site because the well location is approximately 400 feet upgradient of the A-Site. However, the monitoring well was installed in material containing PCB. Therefore, PCB detections at the AMW-3A well may be an artifact of well construction (BBEPC. 1992). The origin of the PCB-containing material is unknown, but appears to be limited in extent, as indicated by additional soil borings in the vicinity.

Results of the 2000 groundwater sampling activities at the A-Site indicate that PCB were detected in the groundwater wells located in the interior of the A-Site (AMW-6A, AMW-8A, AMW-9A, and AMW-10A). Development of a clear understanding of the nature and extent of groundwater contamination and the fate and transport of the contaminants has been complicated by the sample results. Split samples collected at six different wells (AMW-4, AMW-6A, AMW-8A, AMW-9A, AMW-10A, and AMW-10B) by MDEQ and BBL in November 2000 and sent to different laboratories, yielded a range of results. The results for all of the 2000 groundwater sampling activities are presented in Tables 4-16A (BBL data) and 4-16B (MDEQ data).

The following compounds and analytes were detected in the groundwater at the WB/A-OU: aldrin, arsenic, barium, benzene, beryllium, bis(2-ethylhexyl)phthalate, 2-butanone, calcium, chromium, copper, di-n-butylphthalate, iron, magnesium, manganese, mercury, 2-methylnaphthalene, 4-methylphenol, nickel, potassium, selenium, sodium, vanadium, and zinc (Tables 4-9 and 4-10). Barium, cyanide, manganese, mercury, zinc, and bis(2-Ethylhexyl)phthalate were also detected in groundwater samples at the WB/A OU above generic criteria (Tables 4-15 and 4-15A). The generic GSI values are intended to ensure that unacceptable levels of contaminants are not discharged to surface waters. Background concentrations of these

The protection of ecological receptors relative to PCB in sediment is based on reducing the potential risks associated with uptake of PCB by biota through the aquatic pathway. Concentrations of PCB associated with sediment in Davis Creek and the former Olmstead Creek are compared to protective ranges developed in the BERA. The highest PCB concentration detected in Davis Creek was 0.12 mg/kg, indicating risks are below the threshold range (0.5 to 0.6 mg/kg) established by the BERA for protection of aquatic or semi-aquatic ecosystems. Sediments in Davis Creek do not appear to pose an unacceptable risk to ecological receptors. Sediments in the former Olmstead Creek area ranged from 0.31 to 9.9 mg/kg; two samples exceeded the ecological thresholds and therefore indicate an unacceptable risk to ecological receptors. The former Olmstead Creek, which during rain and snow melt events can experience concentrated flow, potentially conveys contaminants directly into the river.

The protection of ecological receptors relative to PCB in surface soil is based on reducing the risks associated with uptake of PCB by biota through terrestrial pathways. To examine potential ecological risks on site, media concentrations are compared to protective ranges developed in the BERA (6.5 to 8.1 mg/kg for omnivorous songbirds and 5.9 to 29.5 mg/kg for carnivorous mammals). PCB concentrations in surface media sampled during the RI exceed these protective ranges and indicate unacceptable risk to terrestrial receptors.

The results of the RI indicated that PCB concentrations detected in surficial residuals within the Willow Boulevard Site (WMW-3A, WMW-4A, WMW-4B, WB-3, WB-4, and WB-5; Figure 11 of *Technical Memorandum 9* [BBL, 1995b], presented in Appendix C) exceeded the 20 mg/kg industrial/commercial value and also exceed the BERA protective range of 6.5 to 8.1 mg/kg PCB. Three locations at the area east of Davis Creek (EDC-1, EDC-5, and EDC-6; see Figure 19) exceeded the BERA protective range of 6.5 to 8.1 mg/kg PCB. PCB concentrations detected in surficial soils, residuals, and sediments associated with the A-Site (Figure 11 of *Technical Memorandum 9* [BBL, 1995b], presented in Appendix C), and the AMW-3A area (i.e., property owned by Georgia-Pacific), and the area south of the A-Site berm did not exceed criteria.

No PCB were detected in surface soil samples collected from the residential area south of the Willow Boulevard Site during the RI, confirming results obtained in 1987 by the MDPH. Figure 21 and Table 81 of the DCS (BBEPC, 1992; Appendix A) show the MDPH sample locations and results of the residential sampling. All of the samples except one had non-detectable concentrations of PCB. One sample contained a total PCB concentration of 0.080 mg/kg and was considered by the MDPH as not posing a threat to public health (Chadzynski, 1987). Surficial soils associated with the Adkins, Wright, Bloomfield, Scott, and Wadsworth properties do not exceed the residential values of 2.5 to 4.0 mg/kg (Figure 21), indicating that there is no

unacceptable risk to those residents from PCB-containing material on these properties. PCBs have not been detected in the residential properties listed above at concentrations exceeding the residential criteria, and the extent of PCBs has sufficiently been defined for these properties.

6.2.1.3 Surface Water

The protection of human health and the environment relative to surface water is based on reducing risks associated with exposure through consumption of contaminated fish, incidental ingestion, and direct contact with surface water that has come in contact with PCB-containing residuals and/or sediment.

Michigan establishes surface water quality criteria to protect the quality of the surface water bodies of the state. The Kalamazoo River, upstream and in the vicinity of this operable unit, does not achieve the State's surface water quality criteria for PCBs (0.00012 ug/L for wildlife, 0.000026 ug/L human cancer value for non-drinking water) or the BERA's 0.00 197 ug/L value; an unacceptable risk may be present. Data collected from surface waters at Davis Creek do not indicate creek waters present an unacceptable risk to human health or environment.

The RI (Section 5.2; Photo 3) indicated a potential for surface water to suspend PCB-containing material when in contact with PCB-containing soils or sediment. Surface water may also erode exposed residuals (e.g., from the Willow Boulevard Site, area south of the A-Site, and the area east of Davis Creek), thereby creating a potential for transport of PCB to the Kalamazoo River. The erosion of bank materials in the AMW-3A area could potentially expose subsurface PCB-containing soils for transport to the creeks and the river. Another potential pathway of PCB to surface water is through failure of the A-Site dike that could result in transport of PCB-containing residuals.

6.2.1.4 Subsurface Soils

The protection of human health and the environment relative to subsurface soils is based on reducing potential risks associated with (1) exposure through incidental ingestion and dermal contact, assuming activity at the site would bring subsurface soils to the surface; (2) transfer of contaminants from soils to water resources. The RI and subsequent investigations indicated that PCB were detected in the subsurface soil samples from Willow Boulevard Site, A-Site, the area south of the A-Site berm, and in the AMW-3A area.

Under current conditions it is possible for PCB in subsurface soils to migrate to groundwater or surface water. In addition, contaminated subsurface soils, unless otherwise restricted, could become surface soils under future land use scenarios. For these reasons, subsurface soils and residuals are compared to the Part 201 generic screening levels for the evaluation of risk, especially the soil criteria for protection of the groundwater surface

provide for the monitoring of soil and groundwater, and does not provide for any active or passive institutional controls to reduce the potential for exposure (e.g., physical barriers, deed restrictions), nor does it address the existing unacceptable human and ecological risks associated with this operable unit. Since no remedial action would be taken, the potential for transport of PCB to the Kalamazoo River via erosion and groundwater transport from the WB/A-OU would tend to increase over time. Also, the toppling of trees due to wind stress and erosion/undercutting of the banks/dikes by river flow could ultimately result in losses of PCB-containing residuals to the river. With the no-action alternative, the potential for exposing PCB-containing residuals would remain. No action would also adversely impact downstream remedial actions. Consistent with the recommendations of OSWER Directive 9285.6-08, *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites* (Feb. 12, 2002), control of source areas is crucial to the success of downstream actions.

Detailed analysis of the alternative follows.

Overall Protection of Human Health and the Environment

Under Alternative 1, the potential for transport of PCB-containing residuals to the Kalamazoo River via surface runoff would remain. Alternative 1 provides no increased protection over the current site conditions, provides absolutely no risk reduction, and would not be protective of human health and the environment.

Compliance with ARARs/TBCs

Alternative 1 would not be in compliance with state and federal ARARs.

Applicable ARARs/TBCs for this alternative are summarized in Table 6-2. Specific ARARs that would directly influence implementation of this alternative are discussed below.

- **Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451, as amended (Part 201).** This state ARAR provides for the identification, risk assessment, evaluation, and remediation of contaminated sites within the state. At sites of environmental contamination, this ARAR establishes generic cleanup criteria, and allows development of additional site-specific criteria to protect the environment, considering ecological risks (Section 20120(a)(17)). While Alternative 1 achieves residential criteria (2.5 to 4 mg/kg) in adjacent residential areas (except portions of the AMW-3A area), on site it could not attain the industrial criterion (20 mg/kg PCB) or cleanup levels (6.5 to 8.1 mg/kg PCB) recommended by the BERA. Implementation of Alternative 1 would not reduce exposure and associated risk to acceptable levels and would not achieve a degree of protectiveness appropriate for the property, as required in Part 201's Section 20120a and 20120b. The potential for

exposure to PCB-containing residuals/soils would still exist. Alternative 1 could not satisfy the requirements for long-term monitoring, would not achieve the requirement to restrict future land use, and would not comply with Part 201 if there is transport (e.g. via venting groundwater) of PCB to surface water.

- **Part 115, Solid Waste Management, of the Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451, as amended (Part 115).** This state ARAR establishes the requirements for closure of a Part 115 permitted landfill. Although the WB/A-OU was not licensed under Act 451, this act is considered an ARAR for the OU (siting requirements excluded). It requires separation between waste and surface water. Implementation of Alternative 1 would not meet the landfill closure criteria of this act.

- **Toxic Substances Control Act, 40 Code of Federal Regulations (CFR) 761 (TSCA.).** TSCA is a federal cleanup statute with a PCB Remediation Waste Rule that provides cleanup and disposal options for PCB remediation waste. The no-action alternative would pose an unreasonable risk of injury to human health or to the environment, could not achieve the requirements of 40 CFR Section 761.61, and could not meet this ARAR.

Long-Term Effectiveness and Permanence

Alternative 1 would not be protective or reliable over time because of the potential for PCB migration due to erosion and transport by surface runoff. Unacceptable risks to human health and the environment would remain. This alternative would be less protective over time and the potential for bank/dike failure would increase.

Reduction in Mobility, Toxicity, or Volume Through Treatment

Alternative 1 provides no active remediation of residuals that would reduce the mobility, toxicity, or volume of PCB-containing residuals through treatment.

Short-Term Effectiveness

Alternative 1 would maintain current conditions and, as such, no short-term increase or decrease in exposure or associated potential risks would occur.

Implementability

Alternative 1 would not involve the implementation of any active remedial responses.

Cost

No cost would be associated with Alternative 1.

- **Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451, as amended (Part 31).** In accordance with the federal Water Pollution Control Act and the federal Clean Water Act, this state ARAR establishes state criteria for rivers, creeks, and floodplain areas, to protect aquatic life and human health. It also establishes water quality standards and monitoring requirements for discharge effluents including stormwater and venting groundwater, specifying standards for several water quality parameters, including PCB. Under Alternative 2, consolidation of PCB-contaminated sediments and soils combined with erosion control measures have the potential to achieve this ARAR. This ARAR must be attained if contaminated groundwater vents to the Kalamazoo River. Any remedial action that results in the unacceptable discharge of injurious substances to the Kalamazoo River will not be considered effective or complete under this ARAR. The portion of this requirement pertaining to floodplains (any excavation below the 100 year flood elevation) substantive requirements of a permit could be satisfied in implementation of this alternative.

- **Part 91, Soil Erosion and Sedimentation Control of the Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451, as amended (Part 91).** This ARAR pertains to soil erosion, sedimentation, and control of erosion and sedimentation. The ARAR requires that an "earth change" (excavation, filling, or grading) be designed, constructed, and completed in a manner that limits the exposed area of any disturbed land for the shortest possible period of time, as determined by the local enforcing agency. It also requires design of temporary or permanent control measures constructed for the conveyance of water around, through, or from the earth change area to limit the water flow to a nonerosive velocity. This ARAR requires installation and maintenance of temporary soil erosion and sedimentation control measures. The ARAR could be attained with controls such as those generally described in this alternative.

- **Part 115 of the NREPA.** This ARAR establishes the requirements for closure of an Act 451 Part 115 permitted landfill. Although the WB/A-OU was not licensed under Act 451, this act is considered relevant and appropriate for the site because the OU is a solid waste disposal area. Because it is not a new disposal area, siting and bottom liner requirements are not appropriate, but capping requirements are. To be compliant with this requirement, the cover system and landfill contents must be protected against a 100 year flood event. There must be physical separation between the waste and surface water, either literally or with engineered barriers. A leachate collection system may be required. Implementation of Alternative 2 could meet appropriate landfill closure criteria of this act.

- **Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451, as amended (Part 55).** These are requirements regarding air emissions. Current PCB emissions are within acceptable limits. Since excavation of select residuals and disturbance of the surface of the Willow Boulevard Site and A-Site during construction could result in increased air emissions, some care would be necessary in final design and remedial action to assure that construction methods do not result in unacceptable emissions. As discussed in Section 5.5, air monitoring performed during the interim response measures conducted between November 1999 and March 2000 indicate that PCB transport via air should not be a factor during implementation of this remedial alternative. Nevertheless, a site-specific Health and Safety Plan would be developed to monitor emissions, prevent worker and community exposure, and confirm compliance with these ARARs.

- **TSCA.** This federal ARAR (specifically the PCB Remediation Waste Rule) applies to Alternative 2 because some material on site has PCB concentrations greater than 50 mg/kg. The materials may be managed under the PCB "Mega" rule (40 CFR 761 et seq.).

  The ARAR could be attained if the USEPA Superfund Division Director, in consultation with the TSCA program, reviews a written application and issues a written determination that the disposal method proposed (Alternative 2) will not pose an unreasonable risk of injury to health or the environment. Such a determination was recently made in a similar situation for the on-site consolidation and containment remedy selected in the ROD for the 12th Street Landfill-OU4 of the API/PC/KR Site.

  It is important to note that the chemical waste landfill requirements found in 40 CFR 761.75(b) do not apply to the WB/A-OU. Rather, the risk-based disposal method proposed under this alternative consists of waste consolidation, bank stabilization, erosion control, installation of a Type III-compliant cover system, and implementation of a long-term monitoring program. Implementation of these containment elements results in the construction of an effective barrier to physically isolate PCB-containing materials from potential human or ecological contact. As long as the USEPA issues a written determination and the integrity of the containment system is maintained in perpetuity, the TSCA ARAR would be satisfied.

- **Rivers and Harbors Act of 1899 (33 USC 403).** The federal Rivers & Harbors Act prohibits unauthorized obstruction or alteration of the navigable capacity of waters of the United States (fill, cofferdams, bulkheads, etc.), except on plans recommended and authorized by the Army Corps of Engineers. CERCLA response actions, however, do not require a permit in which the Corps of Engineers typically gives

Bank Stabilization and Erosion Control Measures

At A-Site, the existing sheetpiling would be removed or cut off below the waterline and the bank area excavated to create a setback from the Kalamazoo River. At Willow Boulevard, because no sheetpiling exists, the existing bank would be excavated and a setback created along the Kalamazoo River. In order to further minimize the potential risks associated with PCB transport resulting from bank failure and/or erosion, new dikes and erosion control measures would be implemented as part of Subalternative 2B.

These activities would provide a physical separation between the river and the OU during extreme flow events, as well as protect the new berms from the erosive forces of the river. Figure 23B presents a conceptual cross-section of the proposed remedial alternative bank stabilization measures.

Overall Protection of Human Health and the Environment

In addition to the protectiveness described under Alternative 2, the consolidation/containment and setback alternative would be an effective remedy for the WB/A-OU and ancillary areas that would eliminate the potential for direct contact with residuals and reduce PCB transport to the Kalamazoo River. Excavation of the existing banks, their re-stabilization, and use of erosion control measures would reduce the potential for failure and subsequent transport of PCB-containing residuals to Davis Creek and the Kalamazoo River. Of critical importance to meeting this criterion is construction of the new bank to protect the landfill cover and contents from a 100 year flood event. Also, a barrier would be necessary discourage people from accessing the site from the river side of the OU. Assuming the setback could achieve the required separation between waste and surface water and that erosion control would protect against a 100 year flood event, subalternative 2B has the potential to meet the RROs.

Compliance with ARARs

ARARs issues beyond those described in Alternative 2 are discussed below:

- **Part 201 of the NREPA.** Subalternative 2B would comply with Part 201 only if there is not significant transport of contaminants to the surface water. The ARAR could be attained with implementation of long term monitoring and a contingent groundwater remedy. Costs for this Subalternative have been developed both with and without groundwater treatment.

- **Part 31 of the NREPA.** Under Subalternative 2B, excavating a setback along the river would likely require water treatment. Substantive discharge requirements of Part 31 could be met by complying with a SRD, issued for the discharge. Ensuring that venting groundwater does not exceed GSI criteria (and

implementing contingency plans if criteria are not met) could achieve this ARAR. Control of runoff/seepage during excavation near the river would also be required.

- **Part 91 of the NREPA.** This ARAR pertains to soil erosion, sedimentation, and control of erosion and sedimentation. The ARAR requires that an earth change be designed, constructed, and completed in a manner that limits the exposed area of any disturbed land for the shortest possible period of time as determined by the local enforcing agency. It also requires design of temporary or permanent control measures constructed for the conveyance of water around, through, or from the earth change area to limit the water flow to a nonerosive velocity. This ARAR requires installation and maintenance of temporary soil erosion and sedimentation control measures. The ARAR could be attained under this subalternative.

- **Part 115 of the NREPA.** A Part 115-compliant cover system would be built under this subalternative. Of critical importance in attaining this ARAR is the need to (1) keep the cover system from being inundated and compromised by flood events (2) ensuring flood events do not cause unacceptable infiltration of the waste, and (3) achieve an adequate degree of separation between waste and surface water. Implementation of Subalternative 2B could meet appropriate landfill closure criteria of this act, but it is likely that significant landfill engineering would be necessary to achieve the required separation and ensure cover integrity.

Subalternative 2B therefore has the potential to be in compliance with all state and federal ARARs.

Long-Term Effectiveness and Permanence

Subalternative 2B would involve the following components, in addition to those mentioned under Alternative 2: creation of a setback buffer, creation of a new bank with stabilization and erosion control. The process options associated with these components are proven and reliable technologies frequently used in both environmental remediation and general construction work. In the long term, the reliability of this subalternative would be managed through inspection of the cap and bank stabilization measures, maintenance, and repair activities as necessary. The details of these activities would be developed during remedial design and compiled into an O&M manual for the site.

Reduction in Mobility, Toxicity, or Volume through Treatment

Subalternative 2B does not address the federal statutory preference for a remedy that employs treatment technologies that permanently and significantly reduce the mobility, toxicity, or volume of PCB-containing

In addition to tasks listed under Alternative 2, this subalternative would entail the following tasks:

- Creation of a setback at the Willow Boulevard portion of the OU;
- Stabilization of the excavation area;
- Construction of new berms;
- Bank stabilization using means engineered to provide habitat.

Components of the subalternative are described below.

Bank Stabilization and Erosion Control Measures

In order to further minimize the potential risks associated with PCB transport resulting from bank failure and/or erosion, bank stabilization and erosion control measures would be implemented as part of Subalternative 2C.

A-Site, AMW-3A, and the area south of the A-Site berm and in the Willow Boulevard drainageway areas would be managed in the same manner as described in Alternative 2. At Willow Boulevard, a horizontal setback would be excavated along the northern boundary and a new ecologically friendly (augmented with organic substrate and growing materials) dike would be installed along the Kalamazoo River. This would provide a physical separation between the river and the OU during extreme flow events, and protect the new berm from the erosive forces of the river. Figure 23A presents a conceptual cross-section of the proposed remedial alternative bank stabilization measures.

Analysis of the subalternative follows.

Overall Protection of Human Health and the Environment

The consolidation/containment and ecologically friendly dike alternative would be an effective remedy for the WB/A-OU and ancillary areas that would eliminate the potential for direct contact with residuals and reduce PCB transport to the Kalamazoo River. This would be accomplished through residuals consolidation, setback creation, new dike construction and stabilization, erosion control, cap placement, institutional controls, and long-term maintenance and monitoring. Bank stabilization and erosion control measures could minimize the potential for bank failure and subsequent transport of PCB-containing residuals to Davis Creek and the Kalamazoo River. Of critical importance to meeting this criterion is construction of the new bank to achieve separation between surface water and waste and protect the landfill cover and contents from a 100 year flood event. This subalternative would achieve physical isolation of the PCB-containing residuals/soils outside the Willow Boulevard Site and A-Site, thereby eliminating the potential for direct contact with PCB in these areas.

This subalternative would reduce long-term effect on riparian habitat, as there would be no new installation of sheetpiling; a more natural interface would be created between the aquatic and terrestrial ecotones. However, a barrier would be necessary discourage people from accessing the site from the river side of the OU. Assuming the setback could achieve the required separation between waste and surface water and that erosion control would protect against a 100 year flood event, Subalternative 2C could meet the RROs.

Compliance with ARARs

Applicable ARARs/TBCs for this subalternative are summarized in Table 6-2. In addition to the ARARs already described under Alternative 2, the specific ARARs that directly influence implementation of this subalternative are discussed below:

- **Part 201 of the NREPA.** Subalternative 2C would comply with Part 201 only if there is not significant transport of contaminants to the surface water. The ARAR could be attained with implementation of long term monitoring and a contingent groundwater remedy. Costs for this Subalternative have been developed both with and without groundwater treatment.

- **Part 31 of NREPA.** Under Subalternative 2C, excavating a setback along the river would likely require water treatment and compliance with a substantive requirements document. With water treatment during construction of Subalternative 2C, consolidation of PCB-contaminated sediments and soils combined with the setback and erosion control measures have the potential to achieve this ARAR. Ensuring that venting groundwater does not exceed Rule 57 criteria (and implementing containment contingency plans if criteria are not met) could achieve this ARAR. Control of runoff/seepage during excavation near the river would also be required.

- **Part 91 of the NREPA.** This ARAR pertains to soil erosion, sedimentation, and control of erosion and sedimentation. The ARAR requires that an earth change be designed, constructed, and completed in a manner that limits the exposed area of any disturbed land for the shortest possible period of time as determined by the local enforcing agency. It also requires design of temporary or permanent control measures constructed for the conveyance of water around, through, or from the earth change area to limit the water flow to a nonerosive velocity. This ARAR requires installation and maintenance of temporary soil erosion and sedimentation control measures. The ARAR could be attained under this subalternative.

- **Part 115 of the NREPA.** A Part 115-compliant cover system would be built under this subalternative. Of critical importance in attaining this ARAR is the need to (1) keep the cover system from being inundated and compromised by flood events (2) ensuring flood events do not cause unacceptable infiltration of the waste, and (3) achieve an adequate degree of separation between waste and surface water. Implementation of Subalternative 2B could meet appropriate landfill closure criteria of this act, but it is likely that significant landfill engineering would be necessary to achieve the required separation and ensure cover integrity.

Subalternative 2C has the potential to meet all ARARs.

Long-Term Effectiveness and Permanence

The process options associated with these components are proven and reliable technologies frequently used in both environmental remediation and general construction work. In the long term, the reliability of this subalternative would be managed through inspection of the cap and bank stabilization measures, maintenance, and repair activities as necessary. The details of these activities would be developed during remedial design and compiled into an O&M manual for the site.

Reduction in Mobility, Toxicity, or Volume through Treatment

Subalternative 2C does not address the federal statutory preference for a remedy that employs treatment technologies that permanently and significantly reduce the mobility, toxicity, or volume of PCB-containing residuals through treatment. However, Subalternative 2C would isolate residuals in place through consolidation of residuals/soils and placement of a Type III cap (including a FML), thereby significantly reducing their mobility. There would be no reduction in the volume or toxicity of PCB-containing residuals under this subalternative.

Short-Term Effectiveness

Subalternative 2C provides an moderate degree of short-term effectiveness due to the nature of excavating materials so close to the river to create the setback. Because of residuals consolidation and cap construction activities, there is a potential short-term increase in PCB exposure to workers during implementation of this subalternative. Potential off-site migration during remedial action also may increase over the short term due to potential dust-borne releases or incidental releases of the residuals to the river. However, compliance with proper health and safety procedures, surface management, and sediment control provisions developed as part of the remedial design would minimize the potential for worker and community exposure and the loss of PCB-

containing residuals. It should be noted that air sampling conducted during the IRA excavation and consolidation activities resulted in no PCB detections in air emissions either in particulate or vapor phase.

Implementability

Implementation of Subalternative 2C involves the following component, in addition to those described under Alternative 2: excavation of contaminated material adjacent to the river, thus impacting implementability. Due to the nature of excavating materials so close to the river to create the setback, implementability is reduced. In the event of GSI exceedances, Subalternative 2C might involve the installation, operation and maintenance of groundwater control and treatment. These are proven technologies and are therefore considered technically feasible. No implementation problems are projected for Subalternative 2C.

The services and materials necessary to implement this subalternative would be readily available. Construction equipment would be obtained locally or transported to the OU from other areas, as appropriate. Discussions with local suppliers have indicated that sufficient quantities of capping materials are available. In addition, based on experience, qualified commercial contractors would be available locally to perform the work.

Subalternative 2C could comply with the requirements of TSCA and Part 115, which are both ARARs for the WB/A-OU. In addition, the substantive requirements of other permits would be met for this subalternative. Therefore, the subalternative is considered administratively feasible.

Cost

For Willow Boulevard, the horizontal setback distance of this subalternative would be established in remedial design. For the purposes of cost analysis, it is assumed the setback would be 50 feet. Given that assumption, estimated capital costs associated with Subalternative 2C is approximately $7.37 million, while the O&M cost is approximately $399,000 per year including costs associated with long-term groundwater monitoring, for a total O&M cost of approximately $4.95 million (based on a 30-year present worth analysis). The total project present worth cost for Subalternative 2C is approximately $11.51million. Costs for a contingency groundwater control and treatment system would increase the capital cost by $2.84 million and the annual O&M cost by $120,000. If groundwater collection infrastructure were placed prior to cap completion, there would be a substantial cost savings in the event that groundwater collection and treatment is required in the future. The total project present worth for Subalternative 2C with groundwater treatment would be $15.84 million. Details of the cost estimate are provided in Table 7-1C.

Overall Protection of Human Health and the Environment

Alternative 4 would be protective of human health and the environment by removing from the Willow Boulevard Site and consolidating PCB-containing materials at the A-Site. This would eliminate risk of exposure to PCB-containing materials at the Willow Boulevard Site, east of Davis Creek, and area south of the A-Site berm. This alternative will also eliminate the potential for direct contact with residuals and reduce PCB transport to the Kalamazoo River by construction of erosion control measures. This would be accomplished through consolidation, erosion control, cap placement, institutional controls, and long-term maintenance. Placement of a cap system that includes a FML would decrease infiltration, thereby reducing the potential for PCB to leach into the groundwater. This alternative would achieve the RROs and substantially reduce risk through the removal and containment of PCB-containing residuals and soils and the installation of a long-term groundwater monitoring network.

Compliance with ARARs

Applicable ARARs/TBCs for this alternative are summarized in Table 6-2. Specific ARARs that directly influence implementing this alternative are listed below.

- **Clean Water Act, Federal Water Pollution Control Act.** This ARAR establishes federal criteria to protect aquatic life and human health, as well as monitoring requirements for discharging waste treatment effluent to U.S. waters. This alternative would involve treating water (from the dewatering process) prior to discharge to the river. To comply with this ARARs, wastewater would require treatment and handling consistent with a SRD.

- **Part 201 of the NREPA.** This state ARAR provides for the identification, risk assessment, evaluation, and remediation of contaminated sites within the state. At sites of environmental contamination, this ARAR establishes generic cleanup criteria, and allows development of additional site-specific criteria to protect the environment, considering ecological risks (Section 20120(a)(17). Appropriate residential criteria (2.5 to 4 mg/kg PCB) are already attained in adjacent residential areas, except in one small area at the end of Carlton Avenue; this area can be easily addressed under Alternative 4. On site, implementation of Alternative 4 would also achieve industrial criteria (20 mg/kg PCB) and the cleanup levels (6.5 to 8.1 mg/kg PCB) recommended by the BERA in the appropriate areas of the site. Areas susceptible to flood inundation would require application of an aquatic cleanup criterion (0.3 to 0.6 mg/kg PCB) or a terrestrial criterion at the lower end of the terrestrial range, depending on projected frequency and duration of flooding.

Implementation of Alternative 4 would achieve generic residential and industrial criteria as well as ecological criteria, since the removal of PCB-containing materials would reduce exposure and associated risk to acceptable levels. Alternative 4 might not comply with Part 201 if there is groundwater transport of contaminants to surface water; however, the ARAR could be attained with implementation of a contingent groundwater remedy. Costs were developed for this contingency for a groundwater collection and treatment system for the A-Site.

- **Part 31 of the NREPA.** This ARAR establishes state standards to be used to ensure contaminants in rivers, creeks, and floodplain area, are protective of aquatic life and human health. It also establishes water quality criteria and monitoring requirements for discharge effluents and venting groundwater, specifying standards for several water quality parameters, including PCB. To meet this ARAR, all wastewater generated to implement this alternative would require treatment prior to discharge in accordance with a SRD. Ensuring that venting groundwater does not exceed Rule 57 criteria (and implementing containment contingency plans if criteria are not met) could achieve this ARAR.

- **Part 91 of the NREPA**. This ARAR pertains to soil erosion, sedimentation, and control of erosion and sedimentation. The ARAR requires that an earth change be designed, constructed, and completed in a manner that limits the exposed area of any disturbed land for the shortest possible period of time as determined by the county or local enforcing agency. It also requires design of temporary or permanent control measures constructed for the conveyance of water around, through, or from the earth change area to limit the water flow to a nonerosive velocity. This ARAR requires installation and maintenance of temporary soil erosion and sedimentation control measures. The ARAR could be attained under this alternative.

- **Part 115 of the NREPA.** This ARAR establishes the requirements for closure of a Part 115 permitted landfill. Although the WB/A-OU was not licensed under Act 451, this act is considered an ARAR for the site. Adequate physical separation between waste and surface water is required. Implementation of the alternative to consolidate the materials at the A-Site would meet appropriate landfill closure criteria of this act.

- **Part 55 of the NREPA.** These ARARs establish regulations regarding air emissions. Current PCB emissions are within acceptable limits. Since excavation of select residuals and disturbance of the surface of